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JUNIPERUS

(junipers)

This genus, containing the junipers and some related plants called cedars, has about 50 to 70 species, mostly shrubs and small trees. The species are widely distributed in the Northern Hemisphere south to tropical mountains to Central America, West Indies, northern and eastern Africa south of the Equator, Himalayas, and Taiwan. Thirteen species are native in the United States.

Junipers usually have thin, shreddy bark. The small leaves are borne in 2's (opposite) or 3's (whorled). They may be scalelike, blunt, and pressed against the twig, or awl-shaped, sharp-pointed, and spreading. They may persist several years.

Male and ovulate strobili are borne at ends of short twigs or along the twigs, mostly on different trees (dioecious), or in a few species on the same tree (monoecious). The strobili are small and berrylike, and blue, blackish, brownish, or whitish in color. They mature at the end of the first or second year (rarely third). Being fleshy, they do not open. There are usually 1 to 4 seeds, sometimes up to 12. Cotyledons 2 or from 4 to 6.

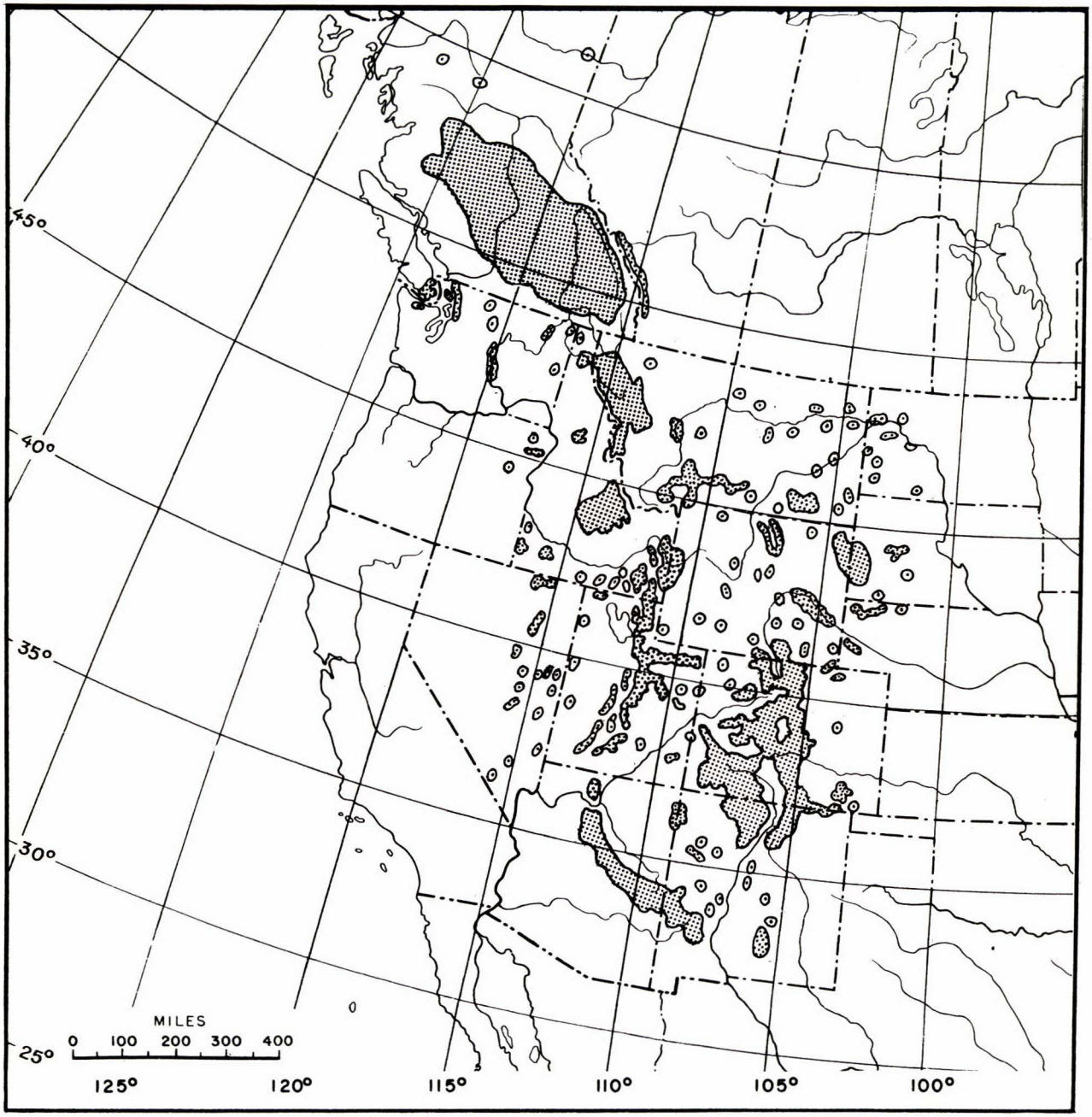
F–490541

ROCKY MOUNTAIN JUNIPER (*Juniperus scopulorum* Sarg.)

Other common names: Redcedar, Rocky Mountain redcedar, river juniper, and cedro rojo.

Rocky Mountain juniper is one of 12 native juniper species that reach tree size in the United States. Lewis and Clark discovered it in October 1804. At first it was thought to be a western form of eastern redcedar, but later a separate species was made because Rocky Mountain juniper berries mature in two seasons instead of one.

Rocky Mountain juniper has a larger range than



F—506599

The range of Rocky Mountain juniper.

any other juniper species found in the West, except common juniper. It grows throughout the drier lower mountains and foothills of Central British Columbia and Southwestern Alberta, Canada; south through the Great Basin, Rocky Mountain, and Northern Plains States, to New Mexico and Arizona (*29*).[1] It also is found on Vancouver and other islands in Puget Sound and on the adjacent mainland. The species grows as far north as Francois Lake in British Columbia and southeast on the east side of the Continental Divide in New Mexico (*36*). It was reported in the Trans-Pecos area of Texas at latitude 31° N. but recent literature (*8*) and distribution maps (*24*) do not verify this.

HABITAT CONDITIONS

Climate

Rocky Mountain juniper generally occupies the dry, subhumid climatic province (*30*). However, it also occupies limited sites in the moist, subhumid region in the central and southern parts of its range (*24*, *29*).

It can endure temperature extremes of −35° to 100° F. (*25*), but it grows best where average minimums exceed −10° to −5°. In different parts of its range average July temperatures range from 60° to 75° and average January temperatures, 15° to 40°.[2]

The growing season or average period when the mean temperature is above 32° F. varies from 140 days at high elevations to 230 days near sea level.

Average annual precipitation varies from 12 inches in the Southwest, Great Basin, and eastern slope of the Rocky Mountains in Colorado, to 26 inches in the Puget Sound area.

May to September precipitation is only about one-fourth the annual total in the northern part of the range, but it equals one-third to more than one-half in the central and southern parts.

Total snowfall varies from about 5 inches on the San Juan Islands in Puget Sound to 150 inches or more in other places.

Soils and Topography

Rocky Mountain juniper grows best on soils that are calcareous and somewhat alkaline (*28*). Soils with pH 8.0 are reported in the Pinyon—Juniper Type on Kaibab limestone in northern Arizona (*22*). The species is considered less drought resistant than other western tree juniper associates (*34*, *36*).

Throughout its range, Rocky Mountain juniper is found on soils derived from basalt, limestone, sandstone, and shale. It grows on lava beds in southern Idaho and eastern Washington and on limestone cliffs in southwestern Montana (*16*). It is found on limestone and sandstone outcrops (*4*, *15*), on limestone and adobe soils of the Rocky Mountain foothills (*20*), and on soils of poor moisture-holding capacity derived from shales in the central part of its range (*13*). It is reported on high limestone plateaus in South Dakota (*23*), and on limestones (*22*) and "malpais" lavas in the southern part of its range (*18*).

Rocky Mountain juniper is a characteristic plant of the McCammon-Deschutes soil group. These soils are stony and shallow, with limy, cemented subsoils, and are subject to rather rapid erosion. In many places where juniper grows, the erosion loss is so great that there is no developed soil.

The range of Rocky Mountain juniper extends from the glaciated valleys of central British Columbia through the foothills of the Rockies to the mesas and tablelands of the Southwestern United States. It grows from near sea level around Puget Sound to 9,000 feet in the Southwest (*19*).

Its elevational range varies with latitude and probably with local climate. In the Pacific Northwest it grows from 0 to 3,200 feet above sea level; northern Idaho, 2,000 to 5,000 feet; Montana, 1,900 to 7,500 feet (*16*). In Utah and Nevada it is found from 3,200 to 8,400 feet, ranging generally from 3,500 to 7,400 feet on southern exposures and from 3,800 to 4,600 feet on northern exposures (*35*). In northern Wyoming it is reported at 5,600 feet (*36*); in Colorado, at 5,500 to 7,000 feet and even 8,500 feet in the extreme southwestern part of the State (*6*). On the eastern slope of the Rockies, it often forms a narrow band between elevations of 6,300 and 6,500 feet (*32*). In Arizona and New Mexico it is found between 5,000 and 9,000 feet, with local variations (*18*, *19*, *22*, *27*).

Throughout its range, Rocky Mountain juniper grows on open exposed bluffs, rocky points, and southern exposures where most trees are unable to exist (*20*). However, it develops best along ravines, in sheltered canyons, and in other protected places (*29*, *30*). It is more common east of the Continental Divide than west of it (*16*).

Associated Trees

Rocky Mountain juniper constitutes an important part of two forest cover types: Rocky Mountain Juniper (Type 220) and Pinyon—Juniper (Type 239). Rocky Mountain juniper occurs as a type only from northern Colorado and Utah northward, where it forms an open woodland in sagebrush, grass, or similar plant communities at

[1] Italic numbers in parentheses refer to Literature Cited, p. 221.

[2] Climatic data have been adjusted to appropriate elevations (*3*).

F–440089

Rocky Mountain juniper invading severe sites in North Dakota.

the lower limits of tree growth. Southward it merges into the Pinyon—Juniper Type, where it is but one of several species that make up the pinyon—juniper complex.

In the northern part of its range, Rocky Mountain juniper is found in open pure stands, or intermingled with ponderosa pine on southern and western exposures, or with Rocky Mountain Douglas-fir on north- and east-facing slopes (*16*).

At higher elevations, it is occasionally found with limber pine, lodgepole pine, whitebark pine, subalpine larch, Engelmann spruce, and subalpine fir (*16*). On the Pacific Coast, Douglas-fir and Oregon white oak are common associates.

In the central and southern parts of its range it is usually found in the less arid parts of the Pinyon—Juniper Type (*27*, *34*, *35*) as in the upper elevational ranges (*14*), in protected situations (*34*), and on deep soils along drainageways. It is usually less abundant than other junipers (*14*), but along waterways it may form nearly pure, uneven-aged stands or mix with narrowleaf cottonwood (*Populus angustifolia*).

It typically associates with the less drought-enduring species found in the type: pinyon, one-seed juniper, ponderosa pine, and oaks (*14*, *36*). In northern New Mexico, it is more abundant when associated with Rocky Mountain Douglas-fir than with ponderosa pine (*18*). It is only on the Coconino Plateau that its range overlaps the ranges of one-seed juniper, alligator juniper (*Juniperus deppeana*), and Utah juniper (*J. osteosperma*) (*33*).

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LIFE HISTORY

Reproduction and Early Growth

Flowering, seed production, and dissemination.—Pistillate flowers first become conspicuous during the late summer. They open the following April, when the pollen is being shed from the staminate flowers (*12*). The fruits ripen in November and December of the second year following pollination and remain on the tree until March or April of the following spring.

Rocky Mountain juniper begins bearing seed when it is 10 years old, but optimum seed-bearing age is 50 to 200 years. Except in parts of Idaho and Montana (*16*), the tree is usually a prolific seeder, especially when stunted (*21*) or growing in the open (*29*). Nearly every year some seed is borne, but particularly heavy crops are produced at intervals of 2 to 5 years (*29*). The small seeds vary from 18,000 to 42,000 to the pound.

Seeds are disseminated primarily by birds. The Bohemian waxwing is known to eat large numbers of the berries (*23*). Lines of bird migration, number of birds, prevalence of juniper berries, and scarcity of other food are undoubtedly factors that affect distribution. Turkeys in the Southwest (*26*), and large mammals, such as bighorn sheep, may play some part in dissemination, but only small amounts of seed are spread by smaller mammals (*23*).

Seedling development.—The seeds do not germinate during the first spring following maturity, but germinate freely during the second spring. They must go through a period of "after-ripening," which may be as long as 14 to 16 months. During that time, several moisture and chemical changes occur within the seed (*1*).

Reproduction is generally sparse, possibly because of delayed germination and inability to establish readily on dry sites. Seedlings are found most often in the moist soil of rocky crevices and in canyons near perennial water (*29*). They do best in nurseries when provided with partial shade for the first year. Seedlings grow slowly; in northern New Mexico and Arizona they are only 1 foot tall after 8 years (*14*).

Juniper seedlings are highly resistant to damping-off, but a juniper blight caused by *Phomopsis juniperovora* is very destructive to nursery-grown seedlings and transplants (*9*, *37*). The disease is rare on wildlings and seldom attacks trees older than 4 years (*10*).

Vegetative reproduction.—Rocky Mountain juniper does not reproduce naturally by sprouts. However, most junipers can be grown from cuttings and some from layers.

Sapling Stage to Maturity

Growth and yield.—Rocky Mountain junipers grow slowly and always remain small. They grow rather uniformly in height to age 40, when they average 13 to 14 feet (*14*). The rate of growth then declines, and 80-year-old trees are about 18 feet tall. Thereafter, they grow quite uniformly, about 0.55 foot per decade, and are 30 feet high when about 300 years old.

Diameter growth is also slow, with a rather uniform growth of 0.79 inch per decade, at 1 foot above ground, from the time the trees are 1 foot tall until they reach an age of about 170 years. The rate then declines over a period of years to another constant rate of about 0.255 inch per decade after the tree is 210 years old. Diameters of trees 300 years old averaged 17 inches at 1 foot above ground (*14*).

In Canada, the trees usually grow to 12 inches in diameter and 10 to 12 feet high, although a few trees have grown as tall as 30 feet. Trees on the north rim of the Grand Canyon are 15 to 20 feet high and 12 to 18 inches in diameter (*7*). Elsewhere in the Southwest, heights of 20 to 50 feet and diameters up to 18 inches are reported (*19*). One extraordinary tree in the Cache National Forest in northern Utah measured 26 feet 8 inches in circumference at breast height and was 45 feet tall (*2*).

They are long lived, possibly 250 to 300 years. One specimen in Logan Canyon, Utah, is reported to be 3,000 years old (*7*).

In northeastern Arizona and northern New Mexico, all species in the pinyon—juniper association averaged about 750 cubic feet per acre for trees with diameters of 3 inches and larger at 1 foot above the ground (*14*). Growth amounted to 9.4 cubic feet per acre annually. Rocky Mountain juniper made up 25 cubic feet or 3.3 percent of the total volume per acre.

Reaction to competition.—Rocky Mountain juniper on moist, cool sites endures rather dense shade during the seedling and early sapling stages. Later it requires top light for height growth, and in dense, pure stands or under the deep shade of other tree species the trunk branches die. In early life it has about the same degree of tolerance as eastern redcedar, but later it is unable to endure as much shade as its eastern counterpart (*29*). In protected canyons and sheltered sites on the Pacific coast, it is able to endure considerable shade of broadleaf trees. In the northern Rocky Mountains, it is considered more intolerant of shade than ponderosa pine, limber pine, or lodgepole pine (*17*).

Junipers in Utah have been observed to invade sagebrush stands on appropriate soils. Pinyon may follow the juniper and has a tendency to replace it (*35*).

Principal enemies.—At least two cedar foliage rusts (*Gymnosporangium globosum* and *G. juniperi-virginianae*) are found on Rocky Mountain juniper (*5*). The latter is the destructive cedar apple blight, for which Rocky Mountain juniper is one of the alternate hosts.

Two similar cedar rusts (*Gymnosporangium betheli* and *G. nelsoni*) cause galls on the stems of Rocky Mountain juniper. Mountain-ash (*Sorbus* spp.), hawthorn (*Crataegus* spp.), apple (*Malus* spp.), and other genera in the rose family act as alternate hosts for them (*5*). Extent of damage to wildlings is unknown, but some of those rusts are destructive to nursery-grown stock.

Juniper mistletoes (*Phoradendron densum* and *P. juniperinum*) are found on Rocky Mountain juniper in Arizona and New Mexico (*31*). Extent of damage is not known.

Several insects attack Rocky Mountain juniper. In Nevada, Oregon, and Washington, a roundheaded borer (*Callidium californicum*) has been found under the twig bark. A bark beetle (*Phloeosinus scopulorum*) attacks it in British Columbia and Washington. Cedar twig beetles (*Phloeosinus* spp.) kill twigs and frequently injure ornamentals and shade trees severely throughout the central and southern parts of its range. Cedar flatheaded borers (*Chrysobothris* spp.) have been found in the bark and wood of weakened, dying, and dead trees. A gall midge (*Walshomyia insignis* Felt) causes an oval apical bud gall.

RACES AND HYBRIDS

Two natural varieties of Rocky Mountain juniper have been reported: *Juniperus scopulorum* var. *columnaris*, found near Amidon, N. Dak., and *J. scopulorum* var. *patens*, found in the Big Horn Mountains of Wyoming and near Banff, Alberta. The former has a long, narrow crown rather than the typical wide, rounded or pyramidal crown. The latter, which may be a hybrid with creeping juniper (*J. horizontalis* Moench), is a depressed shrub (*8*).

Probably the most common hybrids of Rocky Mountain juniper are crosses with eastern redcedar. Hybrid swarms of the two species occur where their ranges overlap in northwest North Dakota, west central South Dakota, and northwest Nebraska. The region of hybridization extends through central Nebraska and Kansas to the Oklahoma border (*8*). These hybrids are referred to as the Platte River race of eastern redcedar (*11*).

In the Southwest, near Flagstaff, Ariz., it appears that Rocky Mountain juniper crosses with alligator juniper (*33*).

Several horticultural and ornamental varieties have been reported. Among these are: *Juniperus scopulorum* var. *viridifolia*, var. *argentea*, and var. *horizontalis*.

Revised from "Silvical Characteristics of Rocky Mountain Juniper," by F. R. Herman. U.S. Forest Serv. Rocky Mountain Forest and Range Expt. Sta., Sta. Paper 29, 20 pp. 1958.

LITERATURE CITED

(1) Afanasiev, M., and Cress, M.
1942. Changes within the seeds of *Juniperus scopulorum* during the processes of afterripening and germination. Jour. Forestry 40: 798–801.

(2) American Forestry Association.
1955. These are the champs. Amer. Forests 61(9): 31–40.

(3) Baker, Frederick S.
1944. Mountain climates of the western United States. Ecol. Monog. 14: 223–254.

(4) Beidleman, Richard G.
1953. The island of pines. Living Wilderness 18(46): 7–10.

(5) Boyce, John Shaw.
1943. Host relationships and distribution of conifer rusts in the United States and Canada. Conn. Acad. of Arts and Sci. Trans. 35: 366–383.

(6) Costello, David F.
1954. Vegetation zones in Colorado. Pp. iii–x. (In "Manual of the plants of Colorado," by H. D. Harrington. 666 pp. Denver.)

(7) Dodge, Natt N.
1936. Trees of Grand Canyon National Park. Grand Canyon Nat. Hist. Bul. 3, 69 pp.

(8) Fassett, N. C.
1945. *Juniperus virginiana, J. horizontalis*, and *J. scopulorum*. V. Taxonomic treatment. Torrey Bot. Club Bul. 72: 480–482.

(9) Hahn, Glenn Gardner.
1941. Reports of cedar blight in 1940 and notes on its previous occurrence in nurseries. U.S. Bur. Plant Indus. Plant Dis. Rptr. 25: 186–190.

(10) ———, Hartley, Carl, and Pierce, Roy G.
1917. A nursery blight of cedars. Jour. Agr. Res. 10: 533–540.

(11) Hall, M. T.
1952. Variation and hybridization in *Juniperus*. Mo. Bot. Gard. Ann. 39: 1–64.

(12) Herman, F. R.
1956. Growth and phenological observations of Arizona junipers. Ecology 37: 193–195.

(13) Hoffman, A. F.
1921. The pinon-juniper land problem. II. Plan for handling the pinon-juniper type. Jour. Forestry 19: 537–541.

(14) Howell, Joseph, Jr.
1940. Pinon and juniper: A preliminary study of volume, growth and yield. U.S. Soil Conserv. Serv. Region. Bul. 71, Region 8, Forest Ser. 12, 86 pp.

(15) Jeffers, D. S.
1921. The pinon-juniper land problem. I. Should the pinon-juniper lands be included in the national forests? Jour. Forestry 19: 534–537.

(16) Kirkwood, J. E.
1922. Forest distribution in the northern Rocky Mountains. Mont. State Univ. Bul. 247, 180 pp.

(17) Larsen, J. A.
1930. Forest types of the northern Rocky Mountains and their climatic controls. Ecology 11: 631–672.

(18) Lindsey, Alton A.
1951. Vegetation and habitats in a southwestern volcanic area. Ecol. Monog. 21: 227–253.

(19) Little, Elbert L., Jr.
1950. Southwestern trees, a guide to the native species of New Mexico and Arizona. U.S. Dept. Agr., Agr. Handb. 9, 109 pp.

(20) Longyear, Burton O.
1925. Evergreens of Colorado. Ed. 2, 82 pp. Fort Collins, Colo.

(21) ———
1927. Trees and shrubs of the Rocky Mountain region with keys and descriptions for their identification. 244 pp. New York.

(22) Pearson, G. A.
1931. Forest types in the Southwest as determined by climate and soil. U.S. Dept. Agr. Tech. Bul. 247, 144 pp.

(23) Phillips, Frank J.
1910. The dissemination of junipers by birds. Forestry Quart. 8: 60–73.

(24) Preston, R. J., Jr.
1947. Rocky Mountain trees: A handbook of the native species with plates and distribution maps. Ed. 2, 285 pp. Ames, Iowa.

(25) Price, Raymond, and Evans, R. B.
1937. Climate of the west front of the Wasatch Plateau in central Utah. U.S. Monthly Weather Rev. 65: 291–301.

(26) Randles, Quincy.
1949. Pinyon-juniper in the Southwest. U.S. Dept. Agr. Yearbook 1949: 342–347.

(27) Rasmussen, D. Irvin.
1941. Biotic communities of Kaibab Plateau, Arizona. Ecol. Monog. 11: 229–275.

(28) Scott, Chas. A.
1929. Trees for eastern Colorado. Colo. Agr. Col. Ext. Bul. 275–A, 36 pp.

(29) Sudworth, George B.
1915. The cypress and juniper trees of the Rocky Mountain region. U.S. Dept. Agr. Bul. 207, 36 pp.

(30) Thornthwaite, C. W.
1948. An approach toward a rational classification of climate. Geog. Rev. 38: 55–94.
(31) U.S. Bureau of Plant Industry, Soils, and Agricultural Engineering.
1950. Index of plant diseases of the United States. Plant Dis. Survey Spec. Pub. 1: 276–281.
(32) Whitfield, C. J.
1933. The vegetation of the Pike's Peak region. Ecol. Monog. 3: 75–105.
(33) Whiting, Alfred F.
1942. Junipers of the Flagstaff region. Plateau 15: 23–32.
(34) Woodbury, Angus M.
1933. Biotic relationships of Zion Canyon, Utah, with special reference to succession. Ecol. Monog. 3: 147–245.
(35) ———
1947. Distribution of pigmy conifers in Utah and northeastern Arizona. Ecology 28: 113–126.
(36) Woodin, Howard E., and Lindsey, Alton A.
1954. Juniper-pinyon east of the Continental Divide, as analyzed by the line-strip method. Ecology 35: 473–489.
(37) Wright, Ernest, and Slagg, C. M.
1942. Some tentative conclusions resulting from plot analyses of Phomopsis-blighted juniper seedlings in Great Plains nurseries during 1941. (Abstract.) Phytopathology 32: 19.